

ENTOMOLOGY.—*A revisional study of the genus Gnathotrichus Eichhoff in North America.*¹ M. W. BLACKMAN, Bureau of Entomology, U. S. Department of Agriculture. (Communicated by HAROLD MORRISON.)

This is the third of a series of revisional studies of *Pityophthorus* Eichh. and its allies in North America. The one remaining genus of the group, *Conophthorus* Hopk., will perhaps serve as the subject of a future study.

Gnathotrichus materiarius Fitch was described by Fitch in 1858 under the name *Tomicus materiarius*. In 1868 Zimmerman referred *materiarius* Fitch to the genus *Crypturgus* Er. and in the appendix to this same paper LeConte (1868) placed it in the genus *Cryphalus* Er. along with *retusus*, *sulcatus*, and *asperulus* described as new, and various other species now included in *Pityophthorus* Eichh., *Pseudopityophthorus* Sw., etc.

Eichhoff in 1868 erected the monobasic genus *Gnathotrichus* to include *G. corthyloides* described by him as new. In a footnote, however, he expressed his belief that this species might be identical with *Tomicus materiarius* Fitch.

LeConte (1876) placed *corthyloides* Eichh. as a synonym of *materiarius* Fitch, which he included, along with the other North American forms described by him, as one division of the genus *Pityophthorus* Eichh.

Eichhoff (1878) in his "Ratio Tomicinorum" placed *corthyloides* as a synonym of *materiarius* Fitch, the type of the genus thus becoming *Gnathotrichus* [*corthyloides*] *materiarius* Fitch. In this same great work Eichhoff described three additional species, *G. longipennis*, *G. consobrinus*, and *G. nanus*, all from Chile, and included a full redescription of the genus.

Blandford (1895) redescribed the genus and added the two new species, *G. consentaneus* and *G. bituberculatus* from Central America.

Hopkins (1902) referred to his manuscript species, *occidentalis*, which apparently has never been described, and in 1905 described *G. nitidifrons* Hopk. from Mexico.

Thus the species listed by Hagedorn (1910) are 11 in number, but *occidentalis* MS Hopk. has never been described, and *asperulus* Lec. was correctly placed by Eichhoff (1879) in the section of the genus *Pityophthorus* Eichh. which was later removed by Swaine (1918) to form the new genus *Pseudopityophthorus* Sw.

¹ Received April 16, 1931.

Swaine (1918) included in the North American members of the genus *Gnathotrichus* not only *materiarius* Fitch, *retusus* Lec., and *sulcatus* Lec., but also *asperulus* Lec., which should have been placed under *Pseudopityophthorus* Sw.

REVISED DESCRIPTION OF THE GENUS GNATHOTRICHUS EICHHOFF

Body form cylindrical, elongate, more than three times as long as wide; the surface very smooth, finely reticulate, varying from subopaque to brightly shining with the punctures varying from fine to minute.

Head with the front convex, either punctured, with the median area elevated, or convergently aciculate, with a few moderate hairs; the antenna with the club more than one and a half times as long as the five-jointed funicle, with segments 2 and 3 subequal in width, and sutures 1 and 2 septate, the females with long curved hairs on the outer border of both club and funicle; the mouth parts with slender hairs; the pregula either normal or protuberant.

Pronotum with the sides not constricted before the middle; the anterior area with numerous very broad and low asperities; the summit anterior to the middle and marked by a sharply elevated, transverse carina; the basal border without a well-developed, beaded margin, although traces of this are to be found in some specimens of all of the North American species.

Elytra finely rugulose, with the strial punctures fine to minute and in definite rows, glabrous or subglabrous except on the posterior third; declivity weakly to strongly sulcate.

The *legs* more slender than in its allies; the tibia rather narrow and gradually widened toward the distal end, which is ornamented with two socketed teeth and in one of the sub-groups by an additional tooth on the outer edge as in other Pityophthori; the tarsi longer and more slender than in *Pityophthorus*.

The members of this genus occurring in the United States are readily recognized owing to their great similarity in general appearance. However, when studied carefully the group readily divides itself into two sub-groups separated by differences nearly as great as those separating other genera of the Pityophthori. These differences have to do with such structures as the front of the head, the pregula, the tarsi, and the tibia of the fore leg.

In *sulcatus* Lec. and *aciculatus*, new species, the front of the head in both sexes is strongly, convergently aciculate over a greater portion of its surface; while in the other group which includes *materiarius* Fitch, *denticulatus*, new species, *retusus* Lec., and *alni*, new species, the frons is punctured, with an impunctate, elevated area in the median line with either very faint or no aciculations. In *sulcatus* and *aciculatus* the pregula is normal, similar in general to the pregula of *Pityophthorus* and most of its allies. In the other group, however, the pregula is swollen and protrudes anteroventrally.

The two groups of species also differ as regards the structure of the fore legs. The general shape of the tibia is rather similar in all of the species but in the *sulcatus-aciculatus* group the submarginal teeth are confined to the distal end and are only two in number, while in the group containing *materiarius*, *denticulatus*, *retusus*, and *alni* these submarginal teeth are three in number as in all of the other Pityophthori, the third tooth being placed on the outer edge of the tibia. Other differences are to be seen in the degree of development of the serrations on the outer edge of the tibia, the modification

at the tarsal joint of the tibia in *sulcatus* and *aciculatus* to form a rudimentary subapical tooth, and in the greater length of the first tarsal joint in this same group.

These differences might be considered great enough to warrant the separation of *sulcatus* and *aciculatus* to form a new genus but the writer does not consider them of more than subgeneric value and believes the true relationship can best be expressed by dividing the genus *Gnathotrichus* into the subgenus *Gnathotrichoides*, new subgenus, including *sulcatus* and *aciculatus*, and the subgenus *Gnathotrichus*, containing the other North American species.

G. nitidifrons Hopk., described from Mexico, belongs to the true *Gnathotrichus*, with the frons not aciculate, the precula protuberant, and the fore tibia tridentate. The position of the other described species can not be determined with certainty, as the descriptions, while excellent in other respects, do not take cognizance of the structures which the present writer considers of greatest subgeneric value. However, on the basis of frontal characters *G. consentaneus* Bldfd. seems to fall into the subgenus *Gnathotrichoides* while *G. longipennis* Eichh., *G. consobrinus* Eichh., *G. nanus* Eichh., and *G. bituberculatus* Bldfd. seem to belong to the true *Gnathotrichus*.

Added note.—Since this paper was written in its final form, the article by K. Schedl (1931) on the *Morphology of the bark-beetles of the genus Gnathotrichus Eich.* (Smithsonian Misc. Coll. Vol. 82, No. 10, Publication 3068; 88 pp., 40 figs.) has appeared. The author has worked out the comparative morphology of the three species known to him in accordance with a very admirable plan, and has added considerably to our knowledge of this group of Scolytidae. In most cases he has also constructed keys to the three species, based on the characters of each set of structures studied. For the most part his findings agree with those of the present writer, but in regard to the structure of the fore-leg he is certainly in error when he says on page 45,—“They (the legs) do not vary strikingly from species to species, neither in form nor in sculpture.” He therefore made all of his drawings and apparently all of the descriptions from *G. materiarius*. On page 48 he says regarding the tibia,—“The sinistral margin bears four to six low serrations, and three marginal teeth which are imbedded in sockets.” This is true of *materiarius* Fitch and *retusus* Lec. and also of the new species *denticulatus* and *alni*, described in the present paper, but is certainly not true of *sulcatus* Lec. and *aciculatus*, new species. These latter two species have but two “marginal” (really submarginal), socketed teeth on the fore tibia and this character serves as one of the principal differences in the subdivision of the genus as proposed by the present writer. There are also other differences in leg structure, as for instance in the greater relative length of the first tarsal segment and in a greater tendency toward the development of a subapical tibial tooth in the *sulcatus* group. But these differences are not tangible enough to lend themselves readily to use in a key.

KEY TO THE GENUS GNATHOTRICHUS EICHHOFF

- A. Front of head punctured at sides, the median area elevated; antennal club with septa of sutures 1 and 2 subtransverse or weakly arcuate; the precula protruding antero-ventrally; fore tibia with three submarginal teeth.

Subgenus *Gnathotrichus* n. sub-gen.

B. Median elevated area of frons smooth; pronotum with posterior area feebly shining, finely, sparsely punctured; elytra more narrowly rounded behind, declivity weakly or moderately sulcate, the sides feebly or moderately retuse; smaller species, less than 3.4 mm. long.

C. Antennal club with septa of sutures 1 and 2 subtransverse; pronotum more narrowly rounded in front, flattened on a triangular area just posterior to summit, posterior area sparsely, very minutely punctured; the declivity feebly sulcate, the sides not distinctly retuse, with the granules nearly obsolete; eastern species

materiarius Fitch.

CC. Antennal club with septa weakly arcuate; pronotum moderately rounded in front; the region posterior to summit not usually flattened, the punctures moderately fine and sparse; declivity distinctly sulcate, the sides moderately retuse and distinctly denticulate; western species. **denticulatus**, n. sp.

BB. Median elevated area of the frons feebly aciculate in the males; posterior area of pronotum at least moderately shining, the punctures moderately fine and sparse; elytra moderately rounded behind, declivity strongly sulcate, the sides strongly retuse; larger species, more than 3.5 mm. long; western species.

C. Slightly smaller, less than 3.8 mm. long; pronotum with carina marking summit shorter, moderately arcuate, and slightly in front of middle; elytra with the declivital sulcus narrower, the sides less strongly retuse, and the granules finer; the posterior margin moderately extended; living in western coniferous trees. **retusus** Lec.

CC. Larger, usually about 4.0 mm. long; pronotum with carina longer, feebly arcuate, and more anterior in position; elytra with the declivital sulcus wider, the sides more strongly retuse, and the granules coarser; the posterior margin more strongly extended; living in western alder. **alni**, n. sp.

AA. Front of the head distinctly convergently aciculate; antennal club with septa of sutures 1 and 2 moderately to strongly arcuate; the pregula not protruding; fore tibia with only two submarginal teeth.

Subgenus *Gnathotrichoides* n. sub-gen.

B. Antennal club with septa of sutures 1 and 2 moderately arcuate; front of head more coarsely aciculate, the punctures coarser and more evident; pronotum with the carina marking the summit moderately elevated and weakly arcuate, posterior area brightly shining, the punctures moderately fine; elytral declivity more abrupt, moderately strongly retuse, the granules coarser. **aciculatus**, n. sp.

BB. Antennal club with septa strongly arcuate; front of head distinctly but finely aciculate, the punctures fine; pronotum with carina weakly elevated, straight and short; posterior area feebly shining, the punctures minute; elytral declivity more sloping, less strongly retuse, the granules minute. **sulcatus** Lec.

Gnathotrichus materiarius Fitch

Figs. 1, 1a, 2, and 3

Description of the adult female.—Dark reddish brown; 3.03 mm. long, 3.29 times as long as wide.

Front of the head plano-convex, rather coarsely, strongly, moderately sparsely punctured at sides and above, with moderately fine, short hairs, median area slightly elevated, impunctate, smooth or very faintly aciculate. *Eye* moderately granulate, the inner line broadly and deeply emarginate. *Antenna* considerably lighter in color, club 1.5 times as long as funicle, 1.29 times as long as wide, widest through the second segment, the septa sub-transverse; with a few very long hairs on the outer margin of the club and funicle. *Pregula* protruding antero-ventrally.

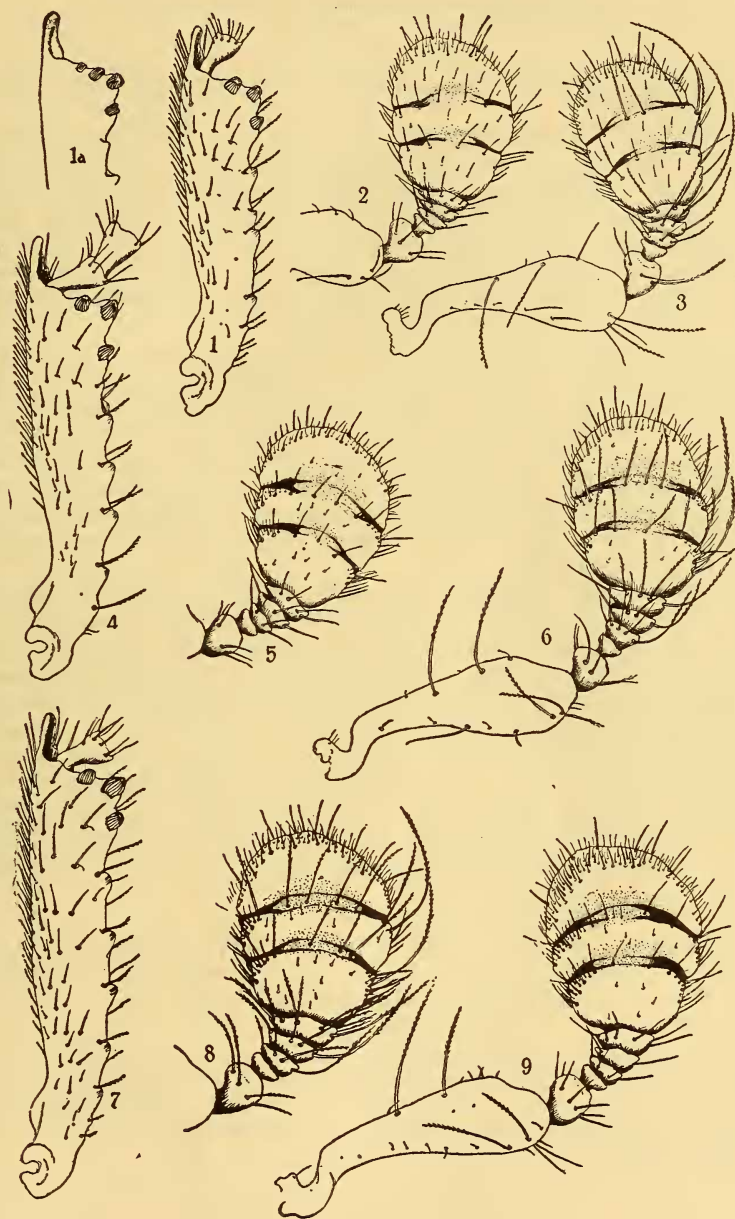
Pronotum 1.29 times as long as wide, widest near the posterior margin, the sides subparallel on the posterior half, then regularly curved to the rather narrowly rounded, slightly extended front margin, which is armed with rather low and broad serrations; anterior area with subconcentric rows of numerous, rather broad and low asperities; the summit modified to form a distinct, well-developed, arcuate, transverse carina, anterior to the middle; the surface posterior to it depressed to form a shallow, median, triangular impression which tapers posteriorly and is lost about half way between summit and posterior margin; posterior area feebly shining, the surface very finely reticulate, minutely, rather sparsely punctulate, glabrous; the beaded marginal line feebly developed.

Elytra nearly exactly twice as long as wide, the sides subparallel, narrowly rounded behind, with the posterior margin extended; surface moderately shining, rugulose; the stria punctures very fine, in fairly regular rows, inter-stria punctures still more minute, very sparse on the disc, which is nearly glabrous, more numerous, and bearing stiff erect hairs of moderate length on the declivity. *Declivity* convex, weakly sulcate in the sutural region, the suture flat, lateral elevations weak, with a few small, nearly obsolete granules.

The *male* is similar in size, proportions, and sculpture, but with the pronotum more broadly rounded in front, and the anterior margin not extended; it is readily distinguished by the absence of the longer hairs on the outer margin of the antennal funicle and club.

The foregoing description of the female was prepared, with the exceptions of the measurements of the antenna, from a specimen now in the National Museum but obtained from the Fitch Collection and bearing the label "*Tomicus materiarius*, Fitch" in Fitch's own hand-writing. It is believed that this specimen served as the type for Fitch's original description.

This species is widely distributed over eastern Canada and the eastern part of the United States. The writer has examined several hundred specimens from the following States: Ontario, Canada, Maine, Vermont, Massachusetts, New York, Pennsylvania, Michigan, Wisconsin, Minnesota, Nebraska, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Mississippi, Louisiana, Arkansas, and Texas. The hosts are the various species of *Pinus*, *Picea*, *Larix*, *Abies*, and *Tsuga* occurring in its range. Other conifers used in plantations or as ornamentals are also subject to attack.



FIGURES.—1. Fore tibia of *Gnathotrichus materiarius* Fitch;—1a. fore tibia of same showing extra tooth on distal end.—2. Antenna of male *G. materiarius*.—3. Antenna of female *G. materiarius*.—4. Fore tibia of *G. denticulatus* n. sp.—5. Antenna of male *G. denticulatus* n. sp.—6. Antenna of female *G. denticulatus* n. sp.—7. Fore tibia of *G. retusus* Lec.—8. Antenna of female *G. retusus*.—9. Antenna of male *G. retusus*.

All figures were made by the writer from preparations mounted in balsam, using a compound microscope and a camera lucida. All are magnified about 112 diameters.

Gnathotrichus denticulatus, new species

Figs. 4, 5, and 6

Description of the adult female.—Reddish brown; 3.28 mm. long, 3.25 times as long as wide.

Front of the head convex, similar to that of *G. retusus* but considerably more finely sculptured, with the median impunctate area wider and less elevated below; pubescence scanty and inconspicuous. *Eye* short oval, broadly and deeply emarginate, rather finely granulate. *Antenna* considerably lighter in color, club 1.6 times as long as funicle, 1.32 times as long as wide, the second segment slightly wider than the third, the septa of sutures 1 and 2 weakly arcuate, with longer hairs on the outer margin of club and funicle. *Pregula* protruding antero-ventrally.

Pronotum 1.19 times as long as wide; widest just behind the middle, the sides slightly arcuate, feebly narrowed in front of the middle, moderately rounded in front; the anterior margin extended and armed with broad, low serrations; the asperities low and broad; summit anterior to the middle and marked by a sharply elevated, transverse, arcuate carina; the region posterior to it impunctate, not flattened or impressed; posterior area with surface subopaque or feebly shining, finely reticulate, the punctures moderately sparse, shallow, much finer than in *retusus*; the posterior margin with little evidence of a beaded line.

Elytra about equal to pronotum in width, slightly more than twice as long as wide; the sides subparallel; rather narrowly rounded behind, with the posterior margin extended; surface shining, rugulose; the strial punctures fine but distinct, in fairly regular rows; interspaces nearly devoid of punctures on the disc but sparsely punctured on sides and declivity and ornamented with stiff, suberect hairs of moderate length. *Declivity* convex, abrupt; the sutural region moderately sulcate (much less so than in *retusus*), the lateral elevations moderate, with a row of denticles in the third interspace.

The *male* is slightly smaller, with the pronotum not extended, broadly rounded in front and the serrations and asperities coarser; the front of the head is more coarsely and roughly punctured, and the antennae lack the long hairs on the outer margin.

Type.—Cat. No. 43430, U. S. N. M.

Type, allotype, and two paratypes bear the labels, "Hopk. U. S. 3984f; W. F. Fiske, Colr.; Cloudercroft, N. M.; *Pinus ponderosa*:" 10 paratypes collected from *Pinus ponderosa* at Cloudercroft, N. M. by W. F. Fiske: four paratypes, "Hopk. U. S. 3899; Davis Mts., Tex., W. F. Fiske, Colr.; *Pinus edulis*:" 18 paratypes collected by Hopkins and Webb at Flagstaff, Ariz., from yellow pine: 18 paratypes collected from *Pinus ponderosa* and *Abies concolor*, Sta. Catalina Mts., Ariz., by J. L. Webb: 11 paratypes collected from *P. ponderosa*, *P. strobiformis*, and *P. chichuahua* by J. L. Webb, Chiricahua Mts., Ariz.

Gnathotrichus retusus Lec.

Figs. 7, 8, and 9

Description of the adult female.—Dark reddish-brown, with the anterior part of pronotum and of elytra slightly lighter in color; 3.5 to 3.8 mm. long, 3.25 times as long as wide.

Front of the head convex, moderately punctured, with a triangular callus above, one angle of which is extended as a strongly elevated smooth ridge on the vertex; below, with an impunctate, shining, median, broad elevation ending in a small, acute epistomal process; pubescence rather scanty. *Eye* short-oval, moderately granulate, the inner line widely, rather deeply emarginate. *Antenna* somewhat lighter in color, the club 1.54 times as long as funicle, 1.23 times as long as wide; second and third segments subequal in width, the septa of sutures 1 and 2 rather weakly arcuate; with longer hairs on the outer margin of the club and funicle. *Pregula* protruding antero-ventrally.

Pronotum 1.29 times as long as wide; the sides subparallel, feebly arcuate, moderately rounded in front, with the anterior margin slightly extended and armed with rather low, wide serrations; the asperities of the anterior area low and broad; summit anterior to middle and marked by an arcuate, rather strongly elevated, transverse, rather short carina, the surface posterior to it slightly flattened on a triangular area narrowing to a point about midway between summit and posterior margin; posterior area glabrous, with the surface finely reticulate, shining, the punctures moderately sparse, deep, and moderately fine; beaded marginal line feebly developed.

Elytra very slightly narrower than pronotum, twice as long as wide, the sides subparallel, feebly converging, moderately rounded behind, with the posterior margin extended; surface shining, rugulose; the strial punctures fine but distinct and rather deep, in regular strial rows; interspaces nearly devoid of punctures on the disc, but on the sides and declivity with a few punctures similar in size to those of the striae and bearing stiff, suberect hairs of moderate length. *Declivity* rather abrupt, convex, strongly sulcate in the sutural area, with the sides strongly retuse and armed with a row of denticles.

The *male* is similar, but with the median carinal area of the frons finely, weakly aciculate, the antenna with the longer hairs of the outer margin absent; the pronotum more broadly rounded and strongly serrate in front, and the sculpture in general slightly coarser.

Specimens of this species examined by the writer were from British Columbia, Washington, Oregon, California, Nevada, Idaho, and South Dakota. The hosts are *Pinus ponderosa*, *P. jeffreyi*, *P. radiata*, *P. lambertiana*, *Pseudotsuga taxifolia*, *Abies magnifica*, and *Tsuga heterophylla*.

G. occidentalis Hopk. MS., mentioned by Hopkins (1902) but not described, appears to be identical with *G. retusus* Lec.

Gnathotrichus alni, new species

Figs. 10, 11, and 12

Description of the adult female.—Dark reddish-brown; 4.04 mm. long, 3.4 times as long as wide.

Front of the head convex, with a triangular callus above, moderately punctured below, except on the elevated, median, carinal space which ends in a small sharp epistomal process, pubescence rather scanty and inconspicuous. *Eye* short-oval, moderately granulate, the inner line broadly, moderately deeply emarginate. *Antenna* lighter in color, the club 1.8 times as long as funicle, 1.3 times as long as wide, second and third segments subequal in width, the septa of sutures 1 and 2 rather weakly arcuate; with a few longer hairs on the outer margin of club and funicle. *Pregula* lighter in color, except on the anterior margin, strongly protruding antero-ventrally.

Pronotum 1.26 times as long as wide, widest near the posterior border, the sides subparallel, feebly converging anteriorly; moderately rounded in front; with the anterior margin extended and armed with very broad, low serrations, asperities very low and broad; summit anterior to the middle, marked by an arcuate, rather strongly elevated carina, longer than in *retusus*, the surface posterior to it slightly flattened on a triangular area which narrows to a point about half way to the posterior border; posterior area glabrous, with the surface finely reticulate, moderately shining, the punctures moderately fine, rather deep, moderately sparse.

Elytra slightly narrower than pronotum, 2.18 times as long as wide, the sides straight and feebly converging, moderately narrowly rounded behind, more narrowly than in *retusus*, with the posterior margin extended; surface brightly shining, rugulose, the stria punctures fine, rather deep, in regular stria rows; interspaces nearly devoid of punctures and nearly glabrous on the disc, more numerous on the sides and declivity, similar in size to those of the striae and bearing stiff, suberect hairs of moderate length. *Declivity* moderately abrupt, less so than in *retusus*, convex, strongly sulcate in the sutural area, more widely than in *retusus*, with the sides strongly retuse and armed with a row of denticles.

The *male* is similar but has the carinal area of the frons weakly and finely aciculate; the antennae lack the longer hairs on the outer margin; the pronotum is more broadly rounded and strongly serrate in front, with the anterior margin not so much extended, and in general the sculpture is slightly coarser.

Type.—Cat. No. 43431, U. S. N. M.

Type, allotype, and three paratypes bear the labels—"Hopk. U. S. 1868a; Burke, Colr., Hoquiam, Wn.; *Alnus*;" one paratype—"Hopk. U. S. 2020; Burke, Colr., Satspo, Wn.; *Alnus oregona*;" one paratype—"Hopk. U. S. 2369a, Hopkins, colr., Hoquiam, Wn.;" one paratype—"Hopk. U. S. 4007a; Burke, Colr., Hoquiam, Wn.; *Alnus oregona*;" one paratype—"Hopk. U. S. 4217b; Burke, Colr., Miller Lg., Wn.; *Alnus oregona*;" one paratype—"Webb 116e; Sequim, Wash.; *Alnus*; J. L. Webb, Colr."

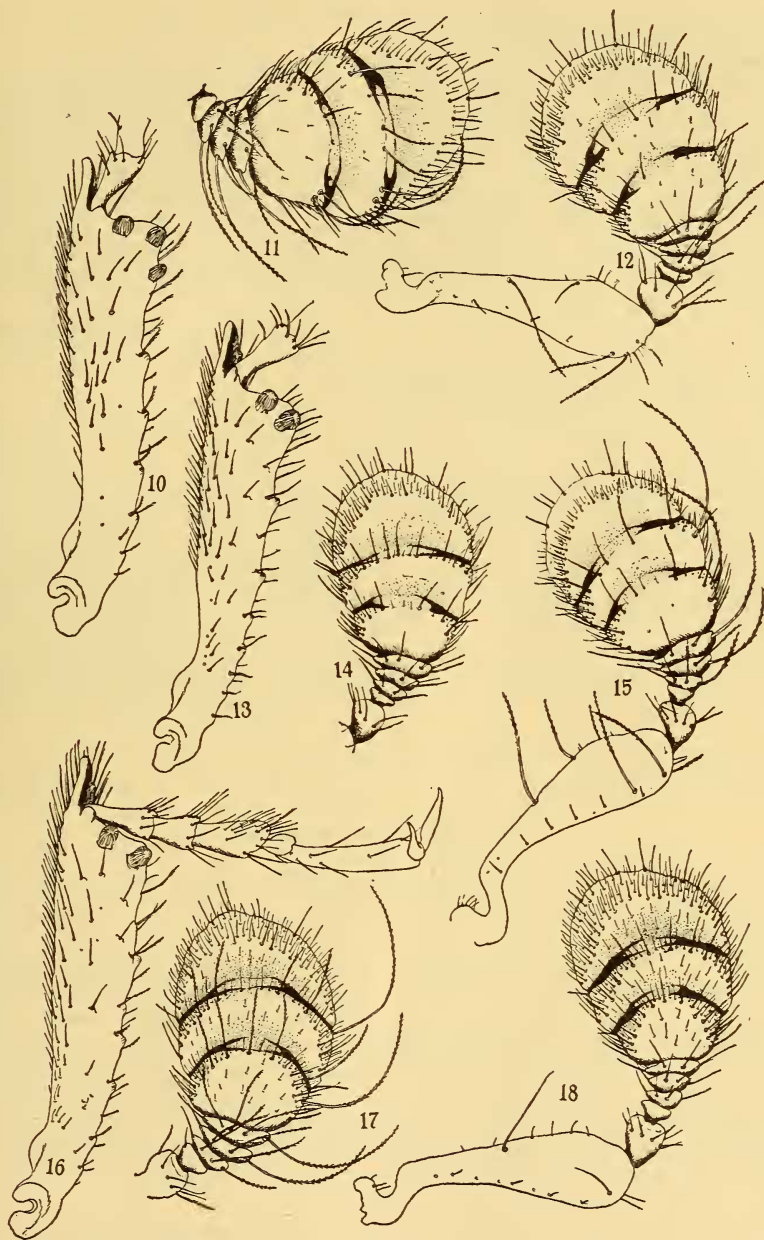
Gnathotrichus aciculatus, new species

Figs. 13, 14, and 15

Description of the adult female.—Dark reddish-brown; 3.54 mm. long, 3.24 times as long as wide.

Front of head similar to that of *G. sulcatus* Lec. but with the aciculations coarser, more coarsely and evidently punctured, and not so deep. *Eye* broad oval, moderately coarsely granulate, the inner line broadly and deeply emarginate. *Antenna* somewhat lighter in color; the club 1.79 times as long as funicle, 1.3 times as long as wide, the second and third segments subequal in width, the septa moderately arcuate, with the usual development of long hairs on the outer margin of club and funicle. *Pregula* normal.

Pronotum 1.28 times as long as wide, the sides subparallel, very feebly arcuate, the front margin distinctly extended, rather narrowly rounded, and armed with moderately broad low serrations, more numerous and sharper than in *sulcatus*; anterior area with the asperities low and broad but much stronger than in *sulcatus*; the transverse carina marking the summit moderately elevated, moderately short, weakly arcuate; the surface posterior to it not modified; posterior area glabrous, with the surface very finely reticulate,



FIGURES.—10. Fore tibia of *Gnathotrichus alni* n. sp.—11. Antenna of female *G. alni* n. sp.—12. Antenna of male *G. alni* n. sp.—13. Fore tibia of *G. aciculatus* n. sp.—14. Antenna of male *G. aciculatus* n. sp.—15. Antenna of female *G. aciculatus* n. sp.—16. Fore tibia of *G. sulcatus* Lec.—17. Antenna of female *G. sulcatus*.—18. Antenna of male *G. sulcatus*.

See note to figures 1-9.

shining, the punctures rather sparse, rather deep, moderately fine; beaded marginal line feebly developed or lacking.

Elytra slightly less than twice as long as wide, the sides subparallel, moderately narrowly rounded behind, with the posterior margin extended; surface brightly shining, densely rugulose; the stria punctures moderately fine, in nearly regular rows; interspaces nearly devoid of punctures on the disc; on the sides and declivity with a few punctures coarser than those of the striae and bearing moderately long stiff hairs more numerous than in *sulcatus*. In the fifth interspace a sparse row extends forward nearly to the middle of the elytra. *Declivity* convex, more abrupt than in *sulcatus* and with the sulcus deeper, the retusions higher and armed with coarser, more numerous granules.

The *male* is slightly smaller and the anterior margin of the pronotum more broadly rounded, not extended, the sculptures slightly coarser, and the antennae show the usual sexual differences.

Type.—Cat. No. 43432, U. S. N. M.

Type and one paratype bear the labels—"Hopk. U. S. 3986b, Cloudercroft, N. M.; *Pinus ponderosa*:" allotype—"Hopk. U. S. 3988, W. F. Fiske, Colr.; Cloudercroft, N. M.; *Pseudotsuga taxifolia*;" one paratype—"Hopk. U. S. 3981b; Cloudercroft, N. M.; *Pseudotsuga taxifolia*:" two paratypes—"Hopk. U. S. 3984f; Cloudercroft, N. M.; *Pinus ponderosa*:" one paratype—"Hopk. U. S. 5708b; J. L. Webb, colr.: Sta. Catalina Mts., Ariz.:" a series of 14 paratypes bearing various lot numbers collected by J. L. Webb, Sta. Catalina Mts., Ariz., from *Pinus ponderosa*, *Abies concolor*, and *Pseudotsuga taxifolia*: a series of 16 paratypes collected by J. L. Webb, Chiricahua Mts., Ariz. from *Abies concolor*, *Pinus ponderosa*, *P. strobiformis*, and *Pseudotsuga taxifolia*: three paratypes—"Hopk. U. S. 7160 & 7164, Rincon Mts., Ariz.; *Pinus ponderosa*:" 54 paratypes collected by J. L. Webb, Black Hills, S. D. from *Pinus ponderosa* under various lot numbers: one paratype—"Hopk. U. S. 12436q; W. D. Edmonston, Colr.; Waldo Canon, Colo.; *Pinus scopulorum*."

Gnathotrichus sulcatus Lec.

Figs. 16, 17, and 18

Description of the adult female.—Dark reddish-brown 3.48 mm. long, 3.3 times as long as wide.

Front of the head convex, strongly convergently aciculate, the median area broadly, indistinctly elevated below, weakly flattened at each side with fine punctures among the aciculations; above smooth, shining, with coarser, sparse punctures and with a distinct median carina on the vertex; ornamented with a few moderate hairs, directed downward. *Eye* broad oval, moderately coarsely granulate, the inner line broadly, moderately deeply emarginate. *Antenna* lighter in color, club 1.78 times as long as funicle, 1.33 times as long as wide; the second and third segments subequal in width, the septa strongly arcuate; with a few much longer hairs on the outer margin of the club and funicle. *Pregula* normal.

Pronotum 1.27 times as long as wide, the sides subparallel, faintly arcuate, the front margin moderately broadly rounded, distinctly extended, and armed with very broad and very low serrations; anterior area with the subconcentric rows of asperities very low and very broad, the summit anterior to the middle and marked with a short, straight, feebly elevated, transverse carina, the surface posterior to it not flattened or impressed except occa-

sionally and then very weakly; posterior area subopaque or feebly shining, the surface very finely reticulate, glabrous, with the punctures shallow, very minute, almost obsolete, and moderately sparse, the beaded marginal line feebly developed, sometimes not to be distinguished.

Elytra twice as long as wide, the sides subparallel, very narrowly rounded behind with the posterior margin distinctly extended; surface feebly shining, densely, minutely rugulose; the striae punctures minute, in fairly regular rows; interspaces nearly devoid of punctures on disc, very minute, more numerous, and bearing stiff erect hairs of moderate length on the declivity. *Declivity* convex, the sutural region moderately sulcate, more strongly than in *materialis* Fitch, much less strongly than in *retusus* Lec., the suture not elevated, lateral elevations moderate, with a row of minute granules in line with the third interspace.

The *male* is similar in general proportions, but with the pronotum more broadly rounded in front and the anterior margin not extended. It is also readily distinguished by the absence of the long hairs on the antennal club and funicle.

Examples of this species have been studied from British Columbia, Washington, Oregon, California, Arizona, New Mexico, and Mexico. It probably breeds in all of the coniferous trees within its range but specimens from the following hosts have been examined by the writer: *Pinus ponderosa*, *Picea engelmanni*, *P. sitchensis*, *Tsuga heterophylla*, *T. mertensiana*, *Pseudotsuga taxifolia*, *Abies concolor*, *A. grandis*, *Sequoiia sempervirens*, *S. washingtoniana*, and *Thuja plicata*.

The above description was prepared from material compared with LeConte's types and found to be identical.

REFERENCES CITED

- BLACKMAN, M. W. *Mississippi bark beetles*. Miss. Agr. Exp. Sta., Tech. Bull. No. 11, 130 pp., 18 pls. 1922.
- BLACKMAN, M. W. *The genus Pityophthorus Eichh. in North America: A revisional study of the Pityophthori, with descriptions of two new genera and seventy-one new species*. Tech. Publ. No. 25., N. Y. S. Coll. Forestry, 182 pp., 11 pls. 1928.
- BLANDFORD, W. F. H. *Family Scolytidae*. Biol. Central. Amer., Coleoptera IV, Pt. 6, pp. 81-298, 6 pls. 1895.
- FITCH, A. *Fourth report on the noxious insects of New York*. N. Y. State Agr. Soc. Ann. Rept. 1857, pp. 687-814. 1858.
- EICHHOFF, W. *Neue Borkenkafer*. Berl. Ent. Zeitschr., XII, pp. 273-280. 1868.
- EICHHOFF, W. *Ratio, descriptio, emendatio Tomieinorum*. Mem. Soc. Roy. Sci., de Liege VIII, 531 pp. 5 pls. 1878.
- HARRIS, T. W. *Characteristics of some previously described North American Coleopterous insects and descriptions of others which appear to be new, in the collection of Mr. Abraham Halsey*. Trans. Nat. Hist. Soc. Hartford, No. 1, pp. 65-91, 1 pl. 1837.
- HOPKINS, A. D. *Insect enemies of the pine in the Black Hills Forest Reserve*. U. S. D. A. Bur. Ent. Bull. 32: 14. 1902.
- HOPKINS, A. D. *Notes on some Mexican Scolytidae, with descriptions of some new species*. Proc. Ent. Soc. Wash., 7: 71-81. 1905.
- HOPKINS, A. D. *List of generic names and their type species in the Coleopterous superfamily Scolytoidea*. Proc. U. S. Nat. Mus., 48: 115-136. 1914.

- HUBBARD, H. G. *The Ambrosia beetles of the United States*. U. S. D. A. Bur. Ent. Bull 7: 1-30. 1897.
- LECONTE, J. L. *Appendix to Zimmermann's synopsis of Scolytidae*. Trans. Amer. Ent. Soc., 2: 150-178. 1868.
- LECONTE, J. L. *The Rhynchophora of America north of Mexico*. Proc. Amer. Phil. Soc., XV, No. 96, 455 pp. 1876.
- PACKARD, A. S. *Insects injurious to forest and shade trees*. V Rept. U. S. Ent. Comm., pp. 1-955. 1890.
- SCHWARZ, E. A. *Remarks on North America Scolytids*. Ent. Amer., 2: 40-42. 1886.
- SCHWARZ, E. A. *Remarks*. Ent. Soc. Wash. Proc. 1: 56. 1888.
- SWAINE, J. M. *Catalogue of the described Scolytidae of America north of Mexico*. N. Y. State Mus., Bull. 134: 75-194. 1909.
- SWAINE, J. M. *Canadian bark beetles*. Dom. Ent. Br. Dept. Agr., Bull. 14, Pt. II, pp. 1-143. 1918.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

PHILOSOPHICAL SOCIETY

1015TH MEETING

The 1015th meeting was held in the Cosmos Club Auditorium, Saturday evening, January 17, 1931. The meeting was called to order at 8:15 P.M. by President CURTIS.

Program: E. O. HULBURT: *The zodiacal light* (illustrated).—Variations in the zodiacal light, from the observations of Jones in 1853-1855 and of more recent observers, are shown to occur during magnetic storms. This indicates that the commonly accepted planet-dust theory of the zodiacal light is untenable and opens the way to an atmospheric theory which is developed quantitatively. Neutral atoms and molecules sprayed out in all directions from the earth's atmosphere are ionized at 50,000 to 70,000-kilometer levels by the ultra-violet light of the sun. Because of the wobble of the earth's magnetic field with the rotation of the earth, ions near the equatorial plane stay for some time at these high levels to form a ring around the earth, and ions at high latitudes fall quickly back to the earth to give aurorae. The gravitational magnetic drift of the ions forces the ion ring into a long oval stretching out away from the sun to 10^6 kilometers. The pressure of the sunlight warps the oval into the plane of the ecliptic and makes the ions stream out like a comet's tail. The ions are fluorescent; they absorb the sun's ultra-violet light and emit a part of the absorbed energy as visible light. The oval ring is the zodiacal light; the comet-tail ion stream is the gegenschein. The zodiacal cones in December are somewhat to the south of the cones in June; the evening cone is south and north of the morning cone in March and September, respectively. These theoretical inferences are in accord with observation. (*Author's abstract.*)

Discussed by Messrs. WHITE, GISH, and CURTIS.

H. T. WENSEL: *The Waidner-Burgess standard of light and the freezing point of platinum* (illustrated).—The unit of light is at present maintained by carbon filament lamps deposited in the various national laboratories. The unit of light is therefore subject to any drift that may occur in the brightness of these standard lamps.